CPU Scheduling

(Please refer to Module 11: Linear Collections: Stacks and Queues (Slide 19))

Table 1. Duration of processes with a **time quantum of 2 units**

Process ID	Arrival Time	Required Time
P1	0	4
P2	1	3
P3	2	2
P4	3	1

Table 2. CPU scheduler during run-time

Unit Time	Queue	Enqueues	Process Being Run
0	Empty		P1 running
1	P2	P2 enters	P1 running
2	P3 P1	P3 enters, P1 re-enters after running	P2 running
3	P3 P1 P4	P4 enters	P2 running
4	P1 P4 P2	P2 re-enters after running	P3 running
5	P1 P4 P2		P3 running and process is completed
6	P4 P2		P1 running
7	P4 P2		P1 running and process is completed
8	P2		P4 running and process is completed
9	Empty		P2 running and process is completed
10	Empty		

Explanation of CPU Scheduler and Processes Running During Run-Time

Keep in mind, queues follow the **FIFO (First-in First-out)** rule, so in the Queue column, the left-most process is the process about to deque after the current process stops running. This will continue until the queue is empty and all processes have finished running.

Each process is only run for 2 units of time at one time since the time quantum in our example is 2 units, but it could also be for example, 3 or 4 units of time.

At unit time = 0, the queue is empty so when P1 arrives at time=0, it starts running immediately.

At unit time = 1, P2 arrives in queue and P1 continues running its second unit of time.

At unit time = 2, P3 arrives in queue and P1 re-enters the queue after it runs its second unit of time as it still has 2 units of time still left to run (max 2 units of time run at one time). P2 deques and starts running.

At unit time = 3, P4 arrives in queue and P2 continues running its second unit of time.

At unit time = 4, P2 re-enters the queue after it runs its second unit of time as it still has 2 units of time still left to run (max 2 units of time run at one time). P3 deques and starts running.

At unit time = 5, P3 continues running its second unit of time and this process is now completed.

At unit time = 6, P1 deques and starts running.

At unit time = 7, P1 continues running its second unit of time and this process is now completed.

At unit time = 8, P4 deques and starts running. This process is now completed.

At unit time = 9, P2 deques and starts running. This process is now completed. Note that the queue is empty as all processes have been completed.

At unit time = 10, all processes are completed, and queue is empty.

Gantt Chart

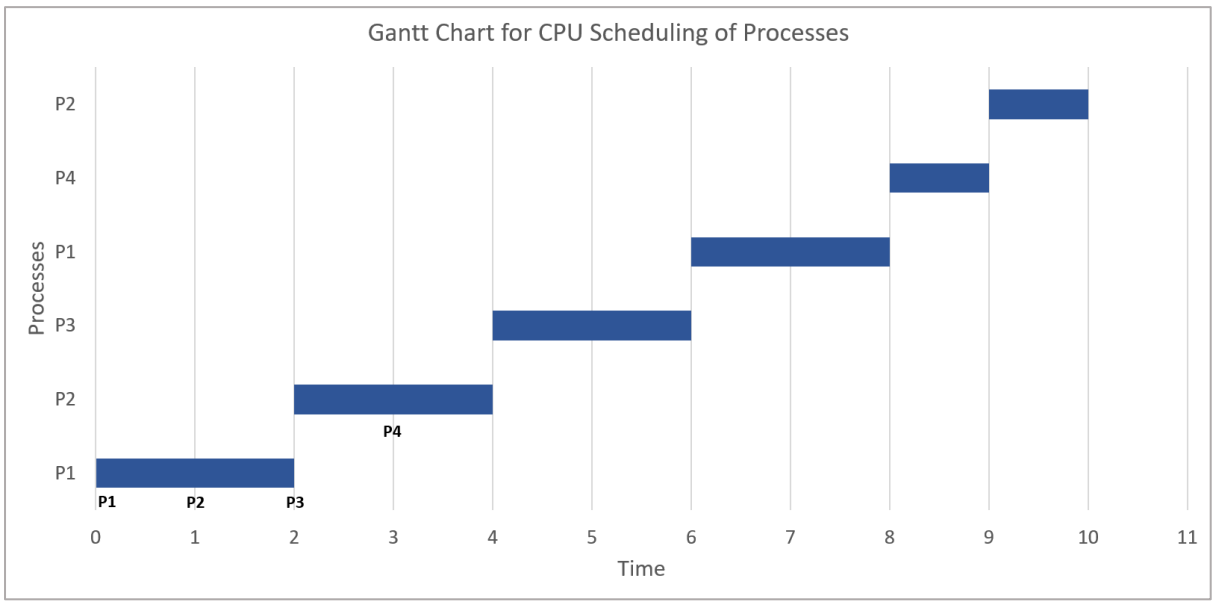

Table 3. Final, Arrival, Required, and Waiting Times for Processes

Process ID	Final Time	Arrival Time	Required Time	Waiting Time*
P1	8	0	4	4
P2	10	1	3	6
P3	6	2	2	2
P4	9	3	1	5

* Waiting Time = Final Time - Arrival Time - Required Time